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Minister of Natural Resources and Energy

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# Gold mineralization in Ordovician rocks of the Rollingdam area in southwestern New Brunswick

**2002 NB Annual Review of Activities**
**Field Trip #2**

New Nouveau Brunswick
Natural Resources and Energy | Ressources naturelles et Énergie

**Freewest Resources Canada Incorporated**

FREEWEST
RESSOURCES FREEWEST CANADA INC.

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# INTRODUCTION

Ongoing exploration activities in southwestern New Brunswick being conducted by Freewest Resources Canada Incorporated are currently focussed on gold mineralization hosted primarily in veins and stockwork zones associated with shallowly to moderately dipping shear zones. These occur within polydeformed Ordovician metasedimentary units proximal to felsic satellite intrusions of the Saint George Batholith. This newly discovered style of mineralization contrasts markedly to the initial gold discovery to the southeast in the Clarence Stream area near Rollingdam, where numerous parallel quartz veins occupy a NE-trending high strain zone that crosscuts Silurian strata proximal to the Magaguadavic Granite phase of the Saint George Batholith (Thorne and Lentz, 2001; Thorne et al., 2001a; b; c; Thorne et al., 2002).

The mineralized zones in the Rollingdam area are analogous to the intrusion-related deposits found in the Tintina Belt in Alaska and the Yukon Territory (see Thompson et al., 1999; Lang et al., 2000; Thompson and Newberry, 2000; Lang and Baker, 2001). Due to these similarities, the intrusion-related style of mineralization has been the main model invoked to guide exploration in the Rollingdam area to date. Although the genetic model for intrusion-related deposits is still being developed, it has been demonstrated that gold mineralization is associated with reduced I-type felsic intrusions that are located in regions known for Sn-W mineralization (Thompson et al., 1999; Lang et al., 2000; Thompson and Newberry, 2000; Lang and Baker, 2001). There are a variety of styles of mineralization described for this genetic model, which vary as a function of their proximity to the associated pluton. Research thus far indicates that the deposit at Clarence Stream is more representative of the proximal style of mineralization described in the intrusion-related model, whereas the mineralization within the newest discovery (Anomaly A) could be related to the distal style of mineralization.

The recent discovery of gold mineralization in the Ordovician rocks in the Rollingdam area broadens the potential for new discoveries in southwestern New Brunswick. The focus of this field trip will be to examine the new occurrences found by Freewest Resources Canada Inc. and to directly observe the structural complexity of the host rocks that complicates their geometry, and hence, interpretation.

# HISTORY OF DISCOVERY AND EXPLORATION

Initial prospecting by Reg Cox Jr. in the Clarence Stream area was initiated as a result of a stream sediment survey conducted by the Geological Survey of Canada in 1992 (Friske et al., 1992). Cox's discovery of high-grade gold-bearing boulders in the Rollingdam area caught the attention of Freewest Resources Canada Inc., who optioned the property and began an extensive exploration program in the fall of 1999. Prospecting by the company uncovered additional mineralized float and outcrop over a 2 km strike length. Subsequent soil sampling based on a 2.5 km long by 1 km wide cut grid revealed numerous mineralized zones that were defined by overlapping Au, As and Sb anomalies. Trenching of these favourable zones uncovered significant mineralization focussed within a shear zone that spanned the length of the property, crosscutting the local Silurian

volcanic sedimentary sequence. Geophysical surveys (IP and total field magnetic) soon followed which led to defining additional trenching targets and subsequently, the completion of numerous drill holes. To date, the prominent mineralized portions of the original grid are referred to as (from west to east) the Cox, West, N, Central and East zones collectively referred to as the Main Zone.

Further regional exploration peripheral to the Main Zone at Clarence Stream was extended to the west, north, and east. Additional line cutting, soil sampling, geophysics and trenching outlined additional mineralized zones with the most promising located approximately 3 km to the northwest of the Main Zone referred to collectively as Anomaly A. Vein and stockwork mineralization, and extensive alteration hosted by Ordovician clastic metasediments of the Kendall Mountain Formation (Cookson Group) predominates in this area. A drilling program to define the geometry of the mineralized zones is in progress at this time.

Numerous other gold showings have been documented throughout the Rollingdam area (e.g. Ruitenberg, 1972; Ruitenberg and Fyffe, 1982; Ruitenberg et al., 1990; McLeod, 1990). Of particular interest, prospecting and exploration by Reg Cox Sr. revealed a high-grade gold showing near Tower Hill, which is currently held by Freewest Resources Canada Inc. By applying the intrusion-related genetic model as an exploration tool, Freewest Resources Canada Inc. decided to focus on the Tower Hill area because of the known gold occurrence proximal to the muscovite-bearing Tower Hill Granite that is very similar in age to the Magaguadavic Granite. Geochemical similarities between the two plutons could indicate greater potential for associated gold mineralization since a genetic link has already been established between the gold at the Main Zone of Clarence Stream and the Magaguadavic Granite (Thorne et al., 2002). Grid cutting, soil sampling as well as other exploration activities are well underway on this property as well.

## REGIONAL GEOLOGY

The zones of mineralization in the Rollingdam area are proximal to a major terrane boundary. The boundary at the surface may be represented in part by the Sawyer Brook Fault, stitched together by the Saint George Batholith. The two major tectonostratigraphic terranes are the St. Croix terrane of the Gander Zone to the northwest (Figure 1; Fyffe and Fricker 1987), and the Late Neoproterozoic to Cambrian New River peri-Gondwanan terrane to the southeast (Figure 1; Johnson and McLeod, 1996; Fyffe et al., 1999). The St. Croix Terrane comprises Ordovician clastic sedimentary rocks of the Cookson Group that includes the Calais, Woodland, and Kendall Mountain formations. Due to the Silurian Mascarene and younger cover sequences and the intrusion of the Saint George Batholith, rocks of the New River Terrane are not exposed in the Rollingdam area and the exact position of the terrane boundary is obscured (Fyffe and Fricker, 1987; McLeod, 1990; Whalen et al., 1994; Fyffe et al., 1999).

The Silurian cover rocks along the northwestern margin of the St. Croix terrane are turbidites of the Fredericton Trough (Fyffe and Fricker, 1987). The syn- to post-sedimentation northeast–trending Sawyer Brook Fault along the southern margin of the St. Croix terrane juxtaposes Silurian, back-arc basin sedimentary and volcanic sequences

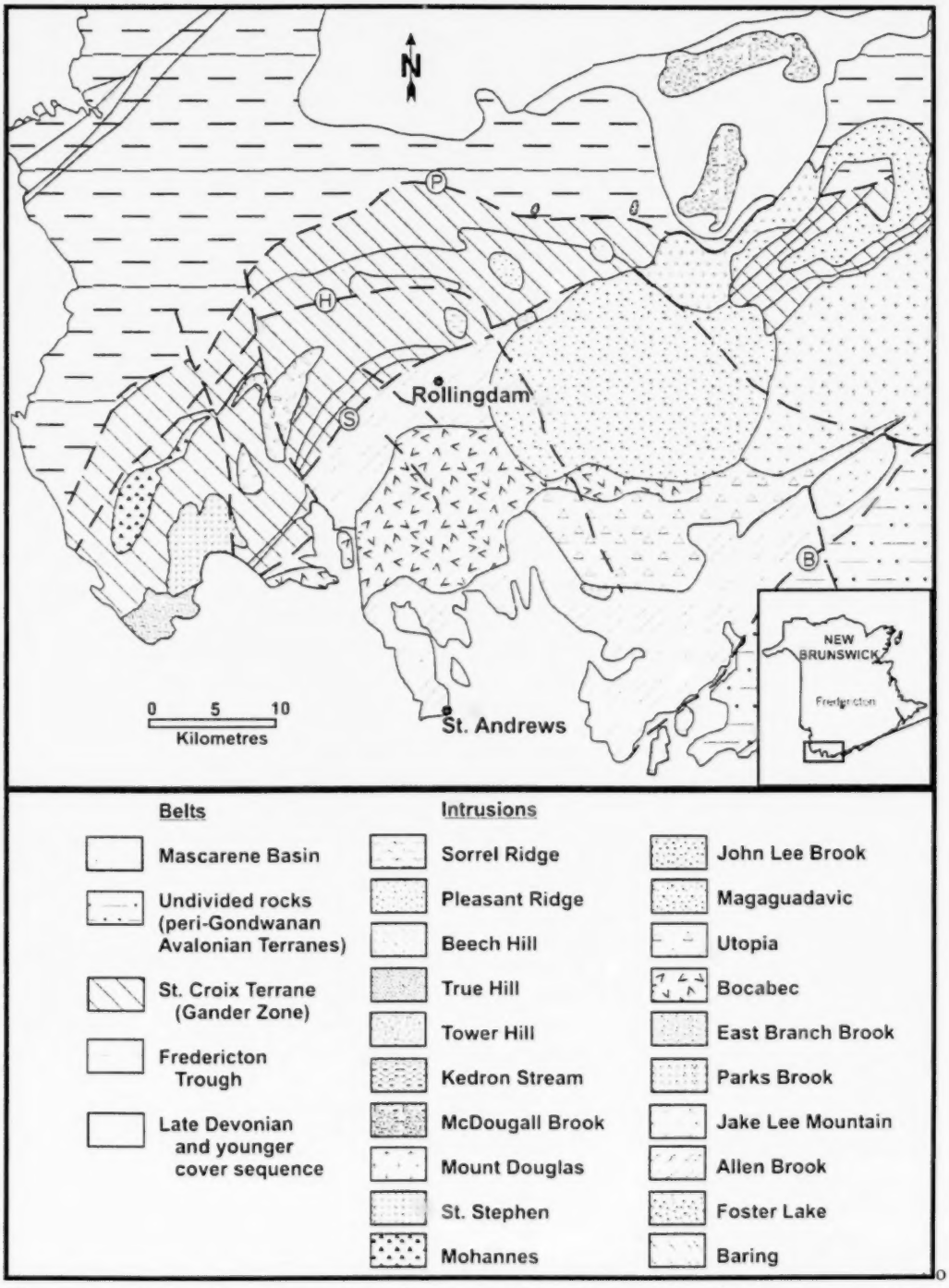


Figure 1. Regional geology of southwestern New Brunswick. Faults (represented by circled letters) include the Pendar Brook (P), Honeydale (H), Sawyer Brook (S), and Back Bay (B) faults. Geology compiled after McLeod (1990), Fyffe (1998), McLeod et al. (1998), and NBDNRE (2000).

of the Mascarene Group (Fyffe et al., 1999). The lower boundary of the section in this area is marked by the presence of polymictic conglomerate in the Oak Bay Formation that contains clasts (volcanic, granite, quartzite and slate) derived from the St. Croix terrane (Fyffe et al., 1999). The conglomeratic unit is overlain conformably by the volcaniclastic and volcanic rocks of the Waweig Formation. The emplacement of the Saint George Batholith, which is bimodal in composition, is strongly controlled by the orientation of faults associated with the proposed terrane boundary (Cherry, 1976). Phases within the Saint George Batholith range from I-type (Magaguadavic) to highly evolved I-type transitional to A-type (Mount Douglas, and the Sorrel Ridge and Beech Hill satellite plutons), to peralkaline A-type (Welsford, Jake Lee; Whalen, 1993). Some of the satellite plutons are highly evolved and muscovite-bearing and have the characteristics of aluminous A-type granites (Tower Hill and Pleasant Ridge; Taylor, 1992; Whalen, 1993). One method of generation of such magmas is as a result of crustal melting initiated by underplating of mafic magma during transpressional movement along the terrane boundaries (McLeod, 1990; Whalen et al., 1994).

At least four phases of deformation have affected the rocks in the Rollingdam area (Ruitenberg, 1967; 1968; 1972; Ruitenberg and McCutcheon, 1982; Fyffe et al., 1991; Castonguay et al., 2002). The rocks of the Ordovician Cookson Group exhibit four phases ($D_1$-$D_4$), although they are not readily distinguishable in any one outcrop. The Silurian rocks of the Mascarene Group southeast of the Sawyer Brook Fault, exhibit a pronounced fabric (resulting from the $D_3$ event) that is deformed at a regional scale by $D_4$ kink and chevron folds (Castonguay et al., 2002).

The $D_1$ and $D_2$ events are attributed to NNW-SSE compression (Ruitenberg and McCutcheon, 1982). $F_1$ folds are isoclinal and gently plunge to the ENE-WSW with a well-developed steeply dipping axial planar cleavage ($S_1$) (Ruitenberg, 1967; 1968; Fyffe et al., 1991; Castonguay et al., 2002). $S_1$ is defined by fine white mica and occasional flattening of quartz grains and is seen to cut the bedding planes at a high angle (Ruitenberg, 1967).

Open to tight $F_2$ folds ($D_2$) that developed in response to similar compressional stresses as $D_1$, deform the bedding as well as the slatey cleavage and have an $S_2$ axial planar cleavage that is slightly oblique to $S_1$ (Ruitenberg, 1967). These $F_2$ folds are normally found to plunge gently to the ENE (Ruitenberg, 1967) with the $S_2$ cleavage developed as a dissolution or crenulation cleavage that generally dips gently to the NW or SE (Fyffe et al., 1991; Castonguay et al., 2002). The culmination of the $D_2$ event was marked by the generation of northwesterly directed thrusts and high angle reverse faults and was followed by the emplacement of the Devonian intrusions (Ruitenberg and McCutcheon, 1982).

$F_3$ folds in the area have been described as steeply to gently plunging to the NE-SW or NW-SE with a steeply dipping axial planar cleavage (Ruitenberg, 1967; 1968; Fyffe et al., 1991; Castonguay et al., 2002). The NE-trending Sawyer Brook Fault, which appears to play a prominent role in the mineralizing event at the Main Zone of Clarence Stream, is a late $D_3$ dextral-slip structure that cuts the southeastern limb of the St. David anticlinorium (Castonguay et al., 2002). The property-wide foliation that is so prominent

in the hosting lithologies at the Main Zone is interpreted to correspond to the regional $D_3$ event (Castonguay et al., 2002).

$F_4$ folds are developed as NW-trending chevron and kink folds (Ruitenberg, 1967; 1968; Fyffe et al., 1991; Castonguay et al., 2002). Castonguay et al. (2002) attributes the deflection of the St. David anticlinorium to this phase of folding and postulates that the NW-trending transverse structures (i.e. Oak Bay Fault) in the area are possibly coeval with this deformation as well.

## LOCAL GEOLOGY

The Main Zone is situated along the northwestern margin within the contact aureole of the Devonian (396 ± 1 Ma, U-Pb zircon; Bevier, 1990), I-type Magaguadavic Granite, a member of the South Oromocto suite of the post-tectonic Saint George Batholith (Figure 1; McLeod, 1990). The current focus of exploration activity by Freewest Resources Canada Inc. (Anomaly A) is located approximately 3 km to the northwest of the Main Zone and is situated between the grantitic Sorrel Ridge and Pleasant Ridge satellite plutons (Pomeroy Intrusive Suite) of the Saint George Batholith. These satellite stocks have associated Sn-W-Mo-Bi mineralization (Lentz et al., 1988; McLeod, 1990) and are relatively younger (Pleasant Ridge, 361 Ma; $^{40}Ar/^{39}Ar$ mica), geochemically dissimilar, and more evolved than the Magaguadavic Granite (Taylor, 1992).

The Tower Hill Granite is situated to the north and west of the main phases of the Saint George Batholith (Figure 1) where it intrudes Ordovician rocks of the Cookson Group. It was initially grouped in with the satellite stocks along the northern margin of the batholith that comprise the Pomeroy Intrusive Suite (McLeod, 1990). However, this intrusion is relatively older than the other satellite stocks to the east and differs geochemically (Butt, 1976, Taylor et al., 1985, Sinclair et al., 1988).

The general geology of the area that will be covered in this field trip is shown in Figure 2. The reader is referred to McLeod et al. (1998) and Fyffe (1998) for more detailed descriptions of the lithological units.

### Tower Hill

#### *Local Geology*

The Tower Hill Granite intrudes the Ordovician rocks of the Kendall Mountain Formation and is dissected by the NW-trending Oak Bay Fault. A Rb-Sr (muscovite) date gave an isochron age of 401 ± 4 Ma (McLeod et al., 1994; Whalen et al., 1996) which is similar in age to the Magaguadavic Granite that is 396 ± 1 Ma (U-Pb zircon; Bevier, 1990). It is a medium- to coarse-grained biotite-muscovite-bearing granite with variable proportions of mica (Fyffe et al., 1981) and accessory zircon and topaz (Whalen

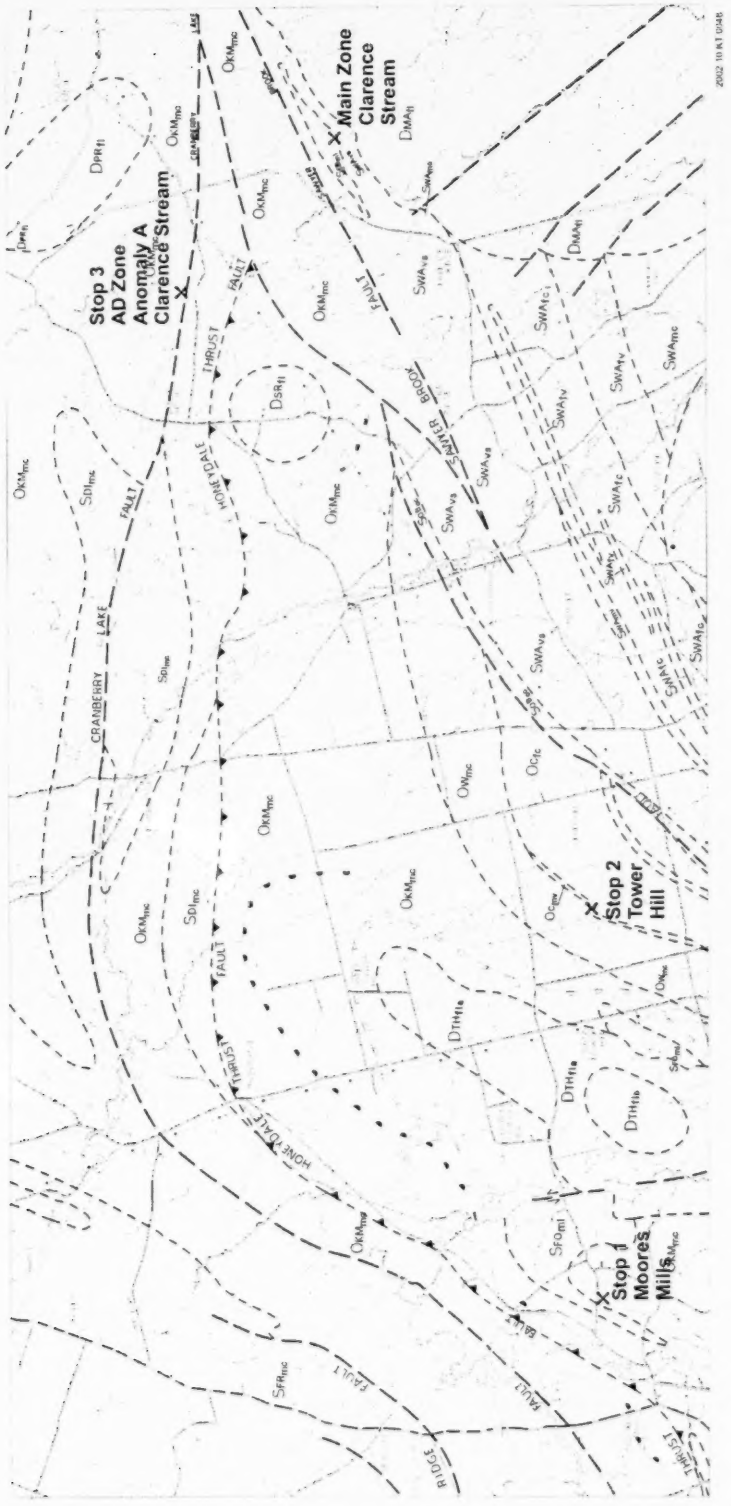


Figure 2. Local geology and location of the field trip stops. Geology from Fyffe (1998) and McLeod et al. (1998).

et al., 1994). The granite has a marginal phase that consists of muscovite granite (leucocratic phase) with abundant associated quartz veins and garnet-tourmaline-bearing pegmatites (Taylor et al., 1985). Along the western margin of the pluton, weakly mineralized fluorite-bearing quartz veins were recognized (Taylor et al., 1985). Butt (1976) interpreted the Tower Hill pluton to have crystallized at high pressures thus implying its emplacement at greater depths than the surrounding plutons. Fyffe et al. (1981) agreed with this argument based on the extensive high-grade contact aureole that surrounds the pluton.

***Exploration History and Highlights***

Prospector Reg Cox Sr. explored the Tower Hill occurrence which consists of massive arsenopyrite within quartz-carbonate veins contained within Ordovician carbonaceous shale and quartzite (Freewest press release, June 20, 2002). This occurrence is situated immediately south of the Honeydale Fault where a regionally penetrative cleavage is deformed by a northeast-trending shear zone, thus generating steeply plunging, cross folds (Ruitenberg et al., 1990). Locally, the shear zone is occupied by mafic sills and dykes that are also deformed (Ruitenberg et al., 1990). The most favourably mineralized quartz veins occur near the quartzite-shale contact as well as along the crests of the cross-folds (Ruitenberg et al., 1990). Grab samples returned values of 89.1 and 19.2 g/t Au and a chip sample ran 50.4 g/t Au, 47.3 g/t Ag and 0.29% Co over 0.76 m (Cox, 1963; Ruitenberg et al., 1990). The relationship of this mineralized zone to the intrusion-related gold systems has yet to be determined.

## Clarence Stream

### Main Zone

***Local Geology***

Results of the exploration activities at the Main Zone indicate that the gold mineralization is focussed within a steeply dipping, brittle-ductile NE-trending splay of the Sawyer Brook Fault that parallels the intrusive contact between the Silurian Waweig volcaniclastic metasedimentary rocks and the Devonian Magaguadavic Granite. Metasediments and volcanics of the Waweig Formation, and crosscutting Silurian East Branch Brook gabbroic dykes (Thorne and Lentz, 2002, in press) are the hosts to NE-trending auriferous quartz veins that occupy the shear zone (Thorne and Lentz, 2001; Thorne et al., 2001a; b; c). Mineralization also consists of disseminations within the wallrocks as well as in late mineralized granitic dykes (Thorne et al., 2002). These mineralized zones are thought to represent the proximal styles of mineralization of the intrusion-related genetic model.

***Exploration Highlights***

Soil sampling of the B-horizon along a grid 2.5 km long by 1 km wide cut grid outlined a number of coincident Au-As-Sb. Subsequent IP and magnetic geophysical

surveys further delineated these anomalies. These targets were later trenched to expose the two most prominent zones of mineralization referred to as the East and West zones.

The East Zone consists of metasediment hosted auriferous quartz veins that contain significant mineralization (up to 575.5 g/t Au in a grab sample). The West Zone is characterized by sheeted quartz veins predominantly hosted within gabbro dykes that occupy a NE-trending brittle-ductile shear zone. These veins occur at the metasediment-gabbro contact as well.

A drilling program that consisted of 64 drill holes was completed in the fall of 2001 in order to test the known mineralized zones (West, N, Cox, Central and East) at depth and along strike. Of the five zones, the Central Zone was the most encouraging with mineralized intervals of:

| Drill Hole | Interval (m) | Grade |
|---|---|---|
| CS01-39 | 21.00 | 15.06 |
| CS01-37 | 14.50 | 5.30 |
| CS01-44 | 9.50 | 21.51 |
| CS01-48 | 9.50 | 4.50 |
| CS01-49 | 11.50 | 3.85 |
| CS01-54 | 11.50 | 3.81 |

The parameters of the Central Zone, as defined by drilling, were found to be 150 m along strike and 180 m down dip (Robertson, 2002). A geological resource of 544,260 tonnes grading 7.2 g/t Au has been defined by the drilling program which is equivalent to 126,000 ounces (Robertson, 2002).

The detailed drilling of the Central Zone indicates that prediction of the size and orientation of the ore shoots will be difficult without fairly detailed drill programs. This difficulty arises because the Main Zone of the Clarence Stream is situated within a high strain zone where late movement along the shear zone dismembered the mineralized bodies both laterally and vertically.

**Anomaly A**

***Local Geology***

Ordovician turbiditic rocks of the Kendall Mountain Formation underlie Anomaly A. The unit consists of quartz arenites argillites and wackes that are variably altered (argillic, silicic, sericitic) where mineralization occurs. The AD Zone comprises syn-deformational stockwork and sheeted quartz veins contained by a shallow, north-dipping brittle fracture zone within polydeformed wacke-argillite. This zone has been tested over a 275 metre strike length in drill holes from 6W to 3+25W and is open in both directions. It is generally less than 50 metres deep. The AD Zone is part of a broader alteration structural envelope that includes the MW Zone, a south-dipping zone of mineralization of similar style located 200 metres north of the AD Zone. Both zones are distinguished by associated arsenopyrite-pyrrhotite wallrock replacement and may be joined at depth.

Multiple episodes of veining are evident within the exposures with early veining consisting of white quartz and quartz-chlorite veining (Watters and Castonguay, 2002). Sulphides (arsenopyrite, stibnite, and pyrite) and visible gold is associated with clear and white quartz veins that may be of the same generation as the earliest veins, however, it is also seen in fractures of the early quartz and with massive quartz-sulphide veins (Watters and Castonguay, 2002). Greisen style mineralization with veins containing chlorite, quartz, fluorite, base metals and carbonate, crosscuts all these earlier episodes of veining and is located vertically beneath a gold mineralized zone (Watters and Castonguay, 2002). This feature is most likely related to the presence of the local felsic intrusions (Watters and Castonguay, 2002) that underlie the area at depth (Thomas and Willis, 1989). It is suggested that the gold-bearing veins systems could represent distal styles of mineralization associated with intrusion-related gold systems.

***Exploration Highlights***

Soil sampling in the fall of 2001 identified a northwest striking multi-element (Au-As-Sb) soil anomaly that is approximately 2.5 km long and varies in width up to 500 m wide. This anomaly is termed Anomaly A and to date includes (from east to west) the Murphy, MW, and AD zones. Mineralized boulders that were scattered across the anomaly contained up to 418 g/t Au. Another anomaly (B) is situated 2 km to the south of Anomaly A and is coincident with an IP geophysical anomaly.

Trenching of the Murphy Zone uncovered polydeformed clastic rocks of the Ordovician Kendall Mountain Formation that were intensely sericitized, silicified and veined by stockwork style mineralization. The Murphy Zone has been exposed thus far over a 400 m strike length and consists of two sets of mineralized quartz veins that contain pyrite, arsenopyrite, stibnite, pyrrhotite, and lesser amounts of sphalerite, chalcopyrite, and locally visible gold (Freewest press release, Apr. 24, 2002). The veins and stockwork are contained within 3 to 10 m thick panels of folded sericitized quartz arenite and mudstone (Freewest press release, Apr. 24, 2002).

Channel sampling of the trenched exposures at the Murphy Zone returned values of 4.81 g/t Au over 5 metres and 3.78 g/t Au over 8.5 m (Robertson, 2002). Drilling of the zone returned assays of:

| Drill Hole | Interval (m) | Grade |
|---|---|---|
| CS02-70 | 9.00 | 7.33 |
| CS02-77 | 3.00 | 8.99 |
| CS02-79 | 5.50 | 3.54 |
| CS02-87 | 3.20 | 4.42 |

Prospecting of the AD Zone situated to the west of the Murphy Zone, uncovered grab samples up to 14.9 g/t Au (Robertson, 2002). Mineralized boulders from the MW Zone assay up to 10.2 g/t Au (Robertson, 2002). Trenching in the area of these two mineralized zones was next to impossible due to the persistence of swampy conditions and the extreme depth of the overburden. Therefore, these zones were tested by means of a drilling program.

Results from drilling revealed that the AD Zone consisted of structurally controlled shallowly dipping mineralization. As of September 2002, the AD Zone was drilled over a strike length of 300 m and a width of 125 m (Robertson, 2002). The best intercepts (Freewest press release, Sept. 5, 2002) include:

| Drill Hole | Interval (m) | Grade |
|---|---|---|
| AD02-13 | 3.00 | 6.32 |
| AD02-14 | 6.73 | 7.09 |
| AD02-15 | 8.50 | 4.31 |
| AD02-16 | 7.50 | 6.41 |
| AD02-17 | 7.95 | 1.23 |
| AD02-18 | 3.00 | 4.17 |
| AD02-19 | 4.40 | 4.03 |

The MW Zone is characterized by a mineralized zone within sericitized wacke and argillites that strikes northeastward with a shallow dip to the south (Freewest press release, Sept. 5, 2002). Two easterly-plunging shoots have been recognized to date (Freewest press release, Sept. 5, 2002). Drilling of the zone returned values that include (Freewest press release, Sept. 5, 2002):

| Drill Hole | Interval (m) | Grade (g/t Au) |
|---|---|---|
| MW02-01 | 11.00 | 5.21 |
| MW02-08 | 15.00 | 11.79 |
| MW02-13 | 6.00 | 6.69 |
| MW02-03 | 7.00 | 9.00 |
| MW02-16 | 10.50 | 15.44 |

The third stop of the field trip will be at a large trench within the AD Zone that was exposed subsequent to drilling as an attempt to better understand the structural controls on mineralization.

## STOP DESCRIPTIONS

### Stop 1 – Moores Mills Quarry *(Sebastien Castonguay, Geological Survey of Canada; Jean-Francois Ravenelle, Freewest Resources Canada Inc.)*

There are at least 3 generations of folds ($F_1$, $F_2$ and $F_4$) exhibited within the rocks of the Kendall Mountain Formation at this location. Of significant importance is the structural style of the second phase of deformation that is nicely displayed on the quarry face. Intrafolial $F_1$ sheath folds can be seen in the southwestern end of the quarry face.

The thick-bedded quartz arenite and interstratified black carbonaceous (Graptolite-bearing) slate of the Kendall Mountain Formation, are deformed in a series of moderately inclined isoclinal $F_2$ folds, which have the lower inverted limb cut by a fault along an arenite-slate contact. This gives a "piggy-back" or duplex-like geometry to the folds at

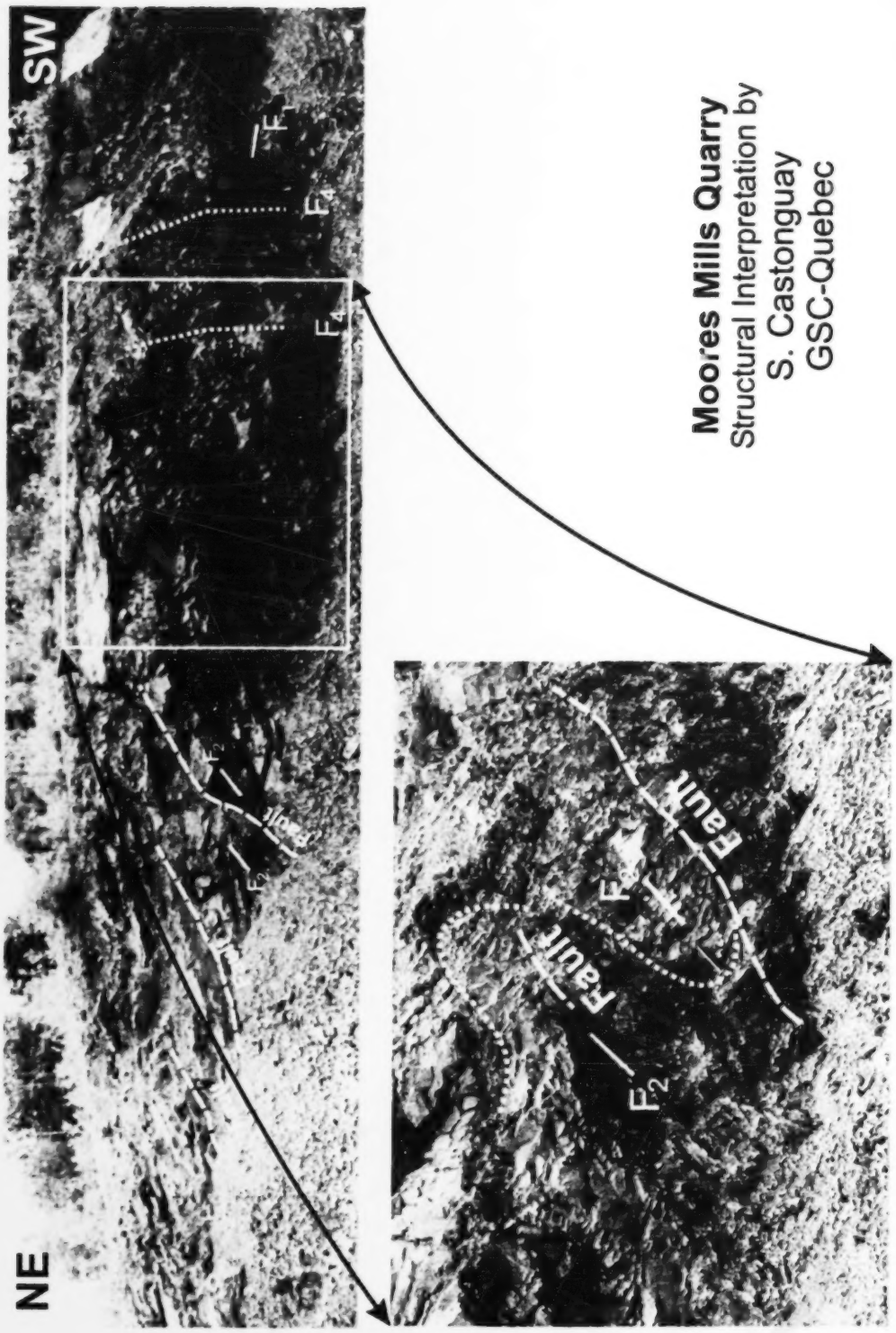


Figure 3. The quarry face of the Moores Mills pit showing the $F_1$, $F_2$ and $F_4$ folds and the location of the faults related to the late $D_2$ deformation.

this location (see Figure 3). The faults are typically marked by 2 to 5 cm of cataclastic breccia and gouge. Quartz carbonate veins and stockworks have been documented at this locality. At the regional scale, documented late $D_2$ high strain zones are often nearly coincident with a change in asymmetry of mesoscopic $F_2$ folds, thus reinforcing the genetic link between $F_2$ folds and locus of faults.

The overall structural control of the mineralized zones at Anomaly A (stop 3) is interpreted to be compatible with $D_2$ thrust-related deformation documented regionally and observed here at the mesoscopic scale. These occur near or at the axial region of a megascopic $F_3$ structure.

## Stop 2 – Tower Hill Au *(Jean-Francois Ravenelle, Freewest Resources Canada Inc.)*

The Black Fly trench (Figures 4 and 5) is located within the Tower Hill area in the upper part of the Calais Formation of the Ordovician Cookson Group. The trench consists of two stripped areas separated by 40 metres. Both areas (Black Fly Trench I – 96 $m^2$ and Black Fly Trench II – 35 $m^2$) have been mapped in detail and channel sampled for gold analyses.

### *Stop 2a – Black Fly Trench I: $F_3$ fold pattern and lithologic control on gold mineralization*

Black Fly Trench I exhibits a folded sequence of amygdular basalt, black shale and metasandstone, intruded by a microgranite dyke (Figure 4). The style and orientation of the fold geometry is consistent with folds generated during the third phase of regional deformation, responsible for the creation of the St. David anticlinorium ($D_3$). A northeast trending, steeply dipping axial-planar foliation ($S_3$) affects the microgranite dyke, suggesting that the latter intruded the sequence before or during $D_3$. The affinity of the microgranite and its relationship to the Tower Hill Pluton has yet to be established. Disseminated mineralization is present throughout the sequence, but significant gold concentrations (138 to 421 ppb) were only detected within the amygdular basalt, suggesting lithologic control on gold mineralization.

### *Stop 2b – Black Fly Trench II: Gold mineralization associated with silicification of microgranite dyke*

Black Fly Trench II, located 40 metres east of Black Fly Trench I, exposes an intensively silicified microgranite dyke that intrudes laminated quartzitic siltstone (Figure 5). The highest gold concentration within the trench (3157 ppb over 1 metre) is associated with arsenopyrite-bearing quartz veins within the microgranite dyke. Thin section work is needed to determine whether or not the $S_3$ fabric affects this vein system, which would indicate whether gold mineralization at this location is pre- or post-$D_3$. Channel sampling and drilling conducted by Reg Cox Sr. mentioned earlier were carried out at this exposure. The relationship (if any) between the microgranite and the Tower Hill pluton is not known at this time.

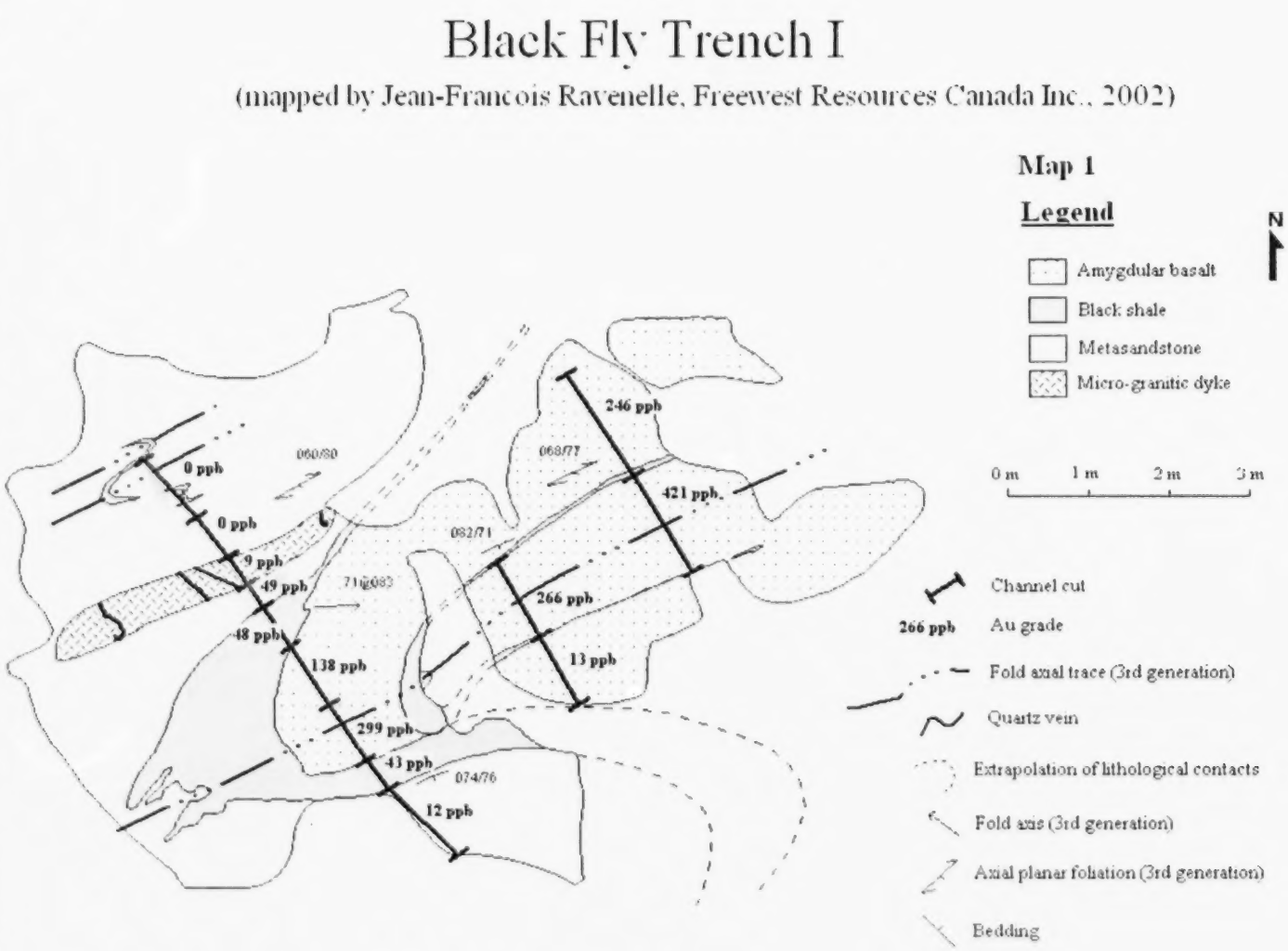


Figure 4. Geology of Black fly Trench 1 at the Tower Hill showing being explored by Freewest Resources Canada Inc.

# Black Fly Trench II

(mapped by Jean-Francois Ravenelle, Freewest Resources Canada Inc., 2002)

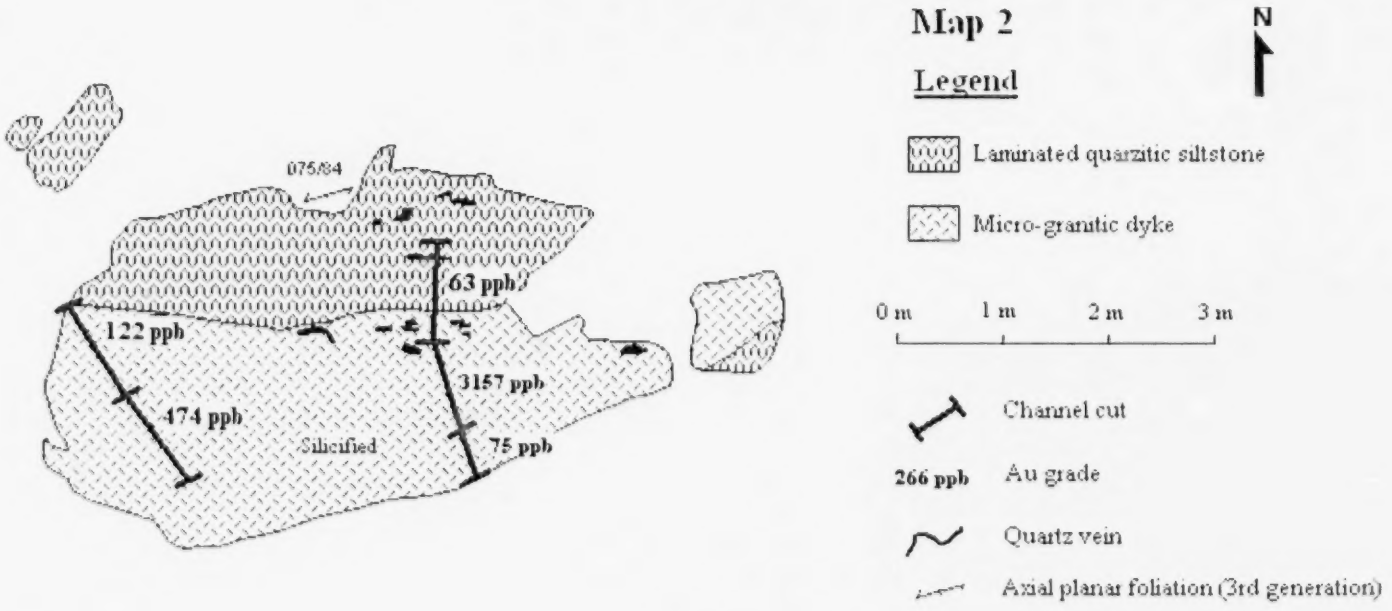


Figure 5. Geological map of Black Fly Trench II at the Tower Hill showing.

## Stop 3 – AD Zone Trench at Clarence Stream Anomaly A *(Glenn Lutes, Jean-Francois Ravenelle, and Don Hoy, Freewest Resources Canada Inc.; Sheila Watters, GSC/NBDNRE)*

The AD trench has exposed the stockwork zone at the western limits of the current drillhole database between L6+00W and L5+50W (Figure 6). This area is located on the west limb of a post-mineralization, major open fold ($D_4$). The main zone is located generally along the southern side of the trench with a general trend of 105° and is closely associated with coarser clastic units (wacke-siltstone) that suggest some control by permeability and porosity in conjunction with structural development. Structural contour maps from drillhole data indicate a general strike of about 070° for the zone. Correlations between drillholes and the surface exposure suggest a dip for the zone of about 25° north in the trench area with steeper and shallower dips indicated along strike to the east. Argillite is the dominant lithology in the section and contains a single cleavage that has largely transposed bedding parallel to cleavage ($D_2$). This cleavage dips generally 50-60° degrees north above the zone with substantially shallower dips indicated below the footwall in holes AD-2 and 4. Tops are generally right-way up through the sections drilled under the trench, however sharp reversals in tops elsewhere suggest isoclinal folding associated with $D_2$ or earlier deformation.

The exposed stockwork zone is closely associated with subhorizontal to shallow east-plunging asymmetric kink folds that have developed generally in the footwall to the zone ($D_3$). These folds have a long subhorizontal limb and a short steep limb with vergence to the south and fold both bedding and cleavage. Open to tight $F_3$ folds are common in drill core in the footwall to the AD Zone and are likewise subhorizontal and asymmetric. Interference between $F_3$ and $F_4$ fold generations in the trench generate a complex overall structural pattern. Early stages of quartz veining are more strongly deformed and locally form cataclasite. The attitude of individual veins and zones of cataclasite may be at least partly controlled by locations of shallow and steep limbs of kink folds.

A locally developed subvertical fracture cleavage post-dates the asymmetric kinks and has a relatively consistent trend at 075-078°. These are developed primarily in the more competent quartz veins and stockwork and are locally infilled by mineralized quartz veinlets at the east end of the trench.

Mineralization is primarily pyrrhotite and pyrite with arsenopyrite and stibnite within quartz veins and veinlets. A preliminary mineralogical study of the AD Zone has identified berthierite ($FeSb_2S_4$) and gudmundite (FeSbS) as common sulfide species. Trace to rare minerals include jamesonite ($FePb_4Sb_6S_{14}$), ullmannite (NiSbS), tetrahedrite ($Cu_{12}Sb_4S_{13}$), cobaltite (CoAsS), sphalerite (ZnS), chalcopyrite ($CuFeS_2$), native antimony (Sb) and nisbite ($NiSb_2$) plus native gold (Au) and aurostibite ($AuSb_2$).

Hole AD02-1 was drilled under the west end of the trench and returned 2.34 g/T Au over 6.5 metres, including 12.7 g/T over 0.5m. Hole AD02-3 was drilled under the east end of the trench and returned 11.60 g/T over 2.50m. A broad zone of sheeted veins in the hangingwall to the main zone returned 1.20 g/T Au over 7.50m in AD02-3. High-

Figure 6. Plan view of the AD Zone showing the location of the AD Trench and drill holes with mineralized intervals.

grade gold intercepts in drilling east of the trench are closely associated with late stibnite-rich sulfide veinlets.

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